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ABSTRACT

Items from a widely used standardized reading achievement test were rated by trained judges according to the degree to which they required an understanding of hierarchical classification. Two subtests were constructed from subsets of items that were identified by their extreme ratings. Subtest A was judged to require classification operations from respondents; subtest B was judged not to require them. Twenty-two third grade students were assessed on five Piagetian classification tasks and designated as classifiers, transitional, or nonclassifiers on the basis of this assessment. The subjects were then administered subtest A and subtest B. Analysis of covariance of the subtest A scores (effects of subtest B controlled) revealed a significant effect for group placement. The results were interpreted to mean that reading test performance is partially influenced by the student's mastery of hierarchical classification because some test items require this ability. Such items discriminate among children on the basis of developmental maturity rather than on instruction-related knowledge. (Author)

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READING COMPREHENSION TEST PERFORMANCE AND HIERARCHICAL CLASSIFICATION

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Running Head: Reading Comprehension and Classification

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Abstract

Items from a widely used standardized reading achievement test were rated by trained judges according to the degree to which they required an understanding of hierarchical classification. 2 subtests were constructed from subsets of items that were identified by their extreme ratings: Subtest A was judged to require classification operations from respondents; Subtest B, not to require them. 22 third graders were assessed on 5 Piagetian classification tasks and designated as classifiers, transitional, or non-classifiers on the basis of this assessment. Subjects were then administered Subtest A and Subtest B. Analysis of covariance of the Subtest A scores (effects of Subtest B controlled) revealed a significant effect for group placement. The results were interpreted to mean that reading test performance is partially influenced by one's mastery of hierarchical classification because some test items require this ability. Such items discriminate among children on the basis of developmental maturity rather than on instruction-related knowledge.

READING COMPREHENSION TEST PERFORMANCE AND HIERARCHICAL CLASSIFICATION

It is probably a truism to claim that tests of reading comprehension require a complicated set of cognitive skills. Not only is it necessary for children taking such tests to understand the meanings of words and sentences, but they must fully grasp the underlying logic of each test item and its syntax. Note the following item taken from a widely used reading comprehension test (Gates & MacGinitie, 1965, p. 4):

> The third grade class went on a trip. They saw the fenced fields, the tall silo, and the powerful tractor. They watched the horses and cows and fed the chicks. They were even allowed to hold the baby rabbits.
>
> A. The children went to a
>
> farm zoo park circus
>
> B. They saw many
>
> engines pigs trees animals

In this example item the child is called upon to do more than remember images of cows, chicks, silo and tractor, for the ability to infer more inclusive class concepts is required as well. The respondent must understand

that horses, cows, chicks and rabbits can be generally classified as animals and also belong to a subset of farm animals. Comprehension tests typically contain a number of items presupposing a facility with hierarchical classification, and probably a variety of other logical abilities are called upon as well.

Most developmental psychologists, particularly those inspired by the work of Piaget, have come to believe that logical thinking gradually develops in an ordered sequence (Ginsburg & Opper, 1969). But all children do not develop at the same rate nor are all the various logical operations discovered simultaneously. Third graders, because they are usually eight- and nine-year-olds, vary markedly in their logical sophistication. While some are able to handle hierarchical classification tasks much like an adult, others demonstrate only a vague understanding of embeddedness or the logic of class inclusion (Inhelder & Piaget, 1964). It is probable, then, that children who lack facility with hierarchical classification will perform poorly on test items requiring this ability. For reading tests with many such items, poor performance may be more indicative of developmental lag than of reading failure due to inadequate instruction.

The authors believe that data obtained from tests of comprehension can provide a far richer and more articulate assessment of reading ability than global test scores alone can convey, for it may be possible to partition such instruments into subparts according to their prerequisite logical operations. Such partitioning would enable teachers to distinguish reading problems due to cognitive immaturity from those related to content. However, partitioning procedures should not be based on *a priori* judgments in isolation. It is vitally necessary to determine if performance on Piagetian tasks of well known developmental validity (e.g., Inhelder & Piaget, 1964; Lavatelli, 1973; Osborn & Osborn, 1974) is empirically linked to performance on test items suspected of requiring similar logical operations. The purpose of the present investigation is to test for such a relationship.

Method

Measures

Reading subtests. Two trained judges, each familiar with Piaget's theory of how classification operations develop, independently rated each comprehension subtest item of

the Gates-MacGinitie Reading Test (Primary C Form 1; see Gates & MacGinitie, 1965) on five-point Likert scales. Higher ratings indicated a judge's certainty that hierarchical classification ability was required to correctly answer the test item. Total ratings were then obtained by summing across the two judges. Two subtests were constructed from subsets of items identified by their extreme ratings: Subtest A included the 14 highest rated items (i.e., those judged by both raters to require classification operations); Subtest B included the 15 lowest rated items. In general, the judges' ratings were in agreement (Spearman-Brown corrected interjudge reliability was .88).

Classification Tasks. Five classification tasks were adapted from those used by Piaget and his colleagues (Piaget & Inhelder, 1964). These problems required: (a) the abstraction of basic attributes; (b) formation of simple and complementary classes; (c) abstraction of rules for class inclusion, intension, and extension; (d) perception of class intersection; and (e) formation of hierarchical classes. Each task is administered individually, requires the use of plastic geometric shapes and picture cards, and is scored dichotomously. A full description of each,

its administration and scoring, will be provided by the authors on request.

Subjects

The subjects were 22 third-graders, 12 girls and 10 boys, who were attending a rural school in central Virginia. The children were predominently from working class and farm homes and ranged in age from 8.4 to 9.5 years; the mean age of the sample was 9.0 years.

Procedure

Each subject was taken individually out of the classroom setting and assessed on the five classification tasks in the school library. The child was awarded a point for every problem judged by the experimenter to be correctly solved. Three days after the last child had been assessed, the subjects were group tested on the two reading subtests. Subtest A and B items were presented in the same order that they appeared on the original Gates-MacGinitie Test, but were not shown in the context of the total battery.

Preliminary analysis revealed that performance on the various classification tasks was moderately intercorrelated; therefore, total scores were obtained for each child by summing across tasks. The internal reliability of these total scores was .71 (Kuder-Richardson Formula 21). Subjects were then assigned to ability groups on the basis of their

total scores. The eight subjects who correctly solved a majority of the tasks were designated "classifiers;" the seven who correctly solved two of the five tasks, "transitionals," the remaining seven, "non-classifiers." In this manner, three groups containing nearly equal numbers of subjects were identified.

Results

The data were sorted according to classification ability and separate descriptive statistics were computed for classifying, transitional, and non-classifying subjects. The resulting means and standard deviations for these groups are shown in Table 1; these same means are depicted graphically in Figure 1. The correlation between Subtest A and Subtest B was .84, confirming the essential parallelness of the two item sets. A three group analysis of covariance

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Insert Table 1 and Figure 1 about here

(Subtest B was the covariate) conducted on the Subtest A scores revealed a significant effect ($p < .05$). Mean Subtest A scores, adjusted for the covariate, are shown in Figure 2; the analysis of covariance summary is presented

in Table 2.

Insert Table 2 and Figure 2 about here

Conclusions

Classification ability, as assessed by the five Piagetian classification tasks, is predictive of performance on some kinds of standardized achievement test items. Youngsters who are poor classifiers, or who are acquiring some primary classification concepts but are "in transition" in developing the ability to classify, are not able to correctly answer reading test items which require classification. Interestingly, the findings indicate that on test items like these, having some classification ability is not an advantage. Classification mastery must be achieved before the test items can be systematically understood.

When performance on the non-classification items is statistically controlled, classification ability is shown to have a significant effect on performance on classification items. This analysis provides evidence that classification ability is not simply another name for more global ability such as reading skill or verbal intelligence.

Youngsters who perform poorly on standardized reading comprehension tests are believed to be poor readers and often receive remedial reading instruction as a result. However, this study reveals that it is at least as likely that their poor performance may be caused by the lack of classification ability, understood to be a developmental aspect of thinking. Thus, achievement on test items like those investigated may be less a matter of reading ability than of cognitive maturity. Children failing these items because they cannot perform the necessary logical operations should be given different instruction and learning opportunities than those whose difficulty originated elsewhere. Remedial reading instruction cannot be substituted for, and will not be effective without, growth toward cognitive maturity and the acquisition of logical thinking abilities.

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Table 1

Means and Standard Deviations of Subtest A as a Function of Group Membership

	Subtest A		Subtest B	
	Mean	S.d.	Mean	S.d.
Classifiers	67.8	18.38	56.5	28.41
Transitionals	52.1	24.21	56.1	25.87
Non-classifiers	41.9	20.88	37.3	23.65

Note--Subtest scores represent percent correct.

Table 2

Analysis of Covariance Summary

Source	SS	df	MS	F
Covariate	884	1	884.0	62.3**
Group	101	2	50.5	3.65*
Residual	255	18	14.2	

*p < .05

**p < .01

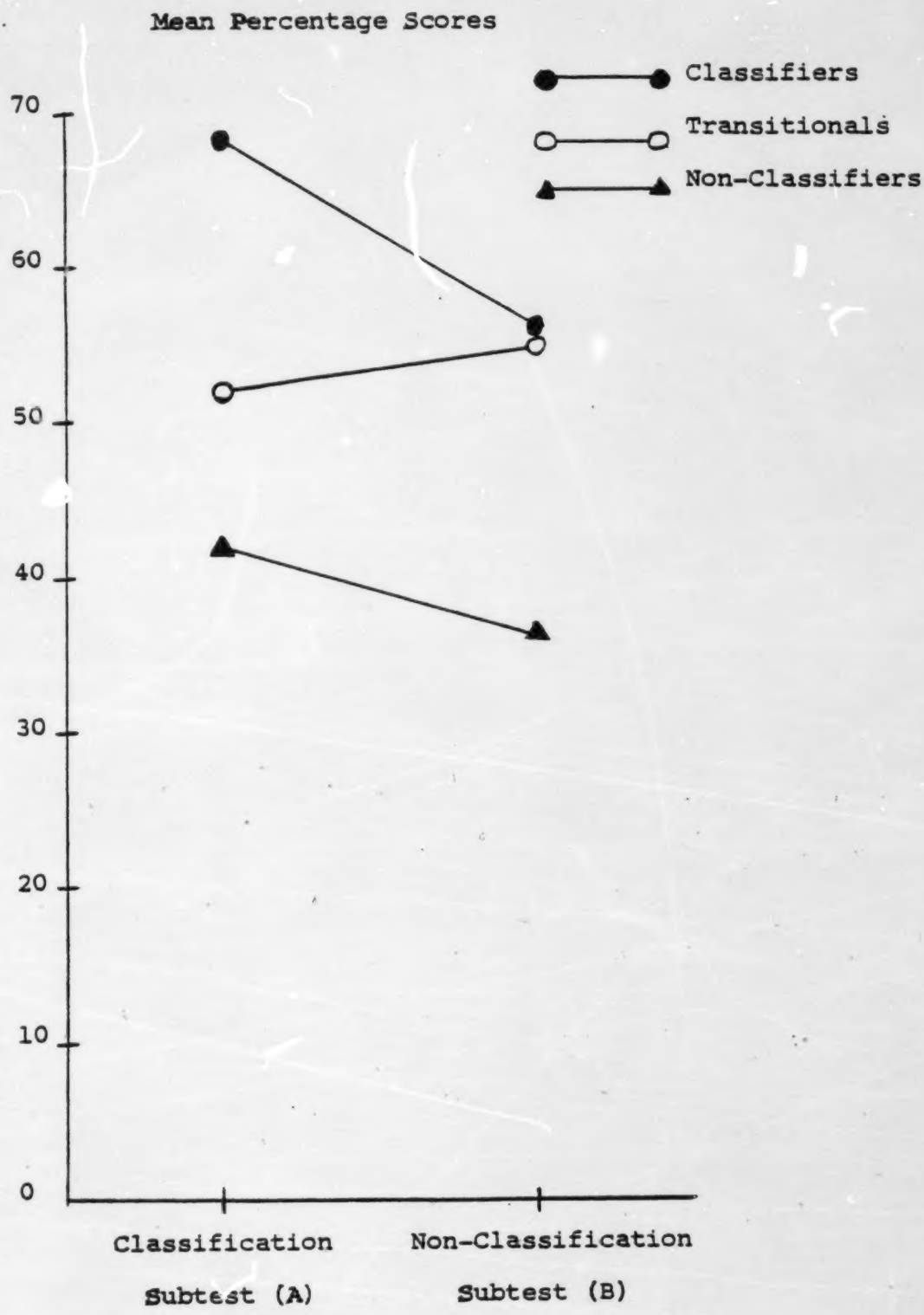
Mean Percentage Scores
Classifiers
Transitionals
Non-Classifiers
70
60
50
40
30
20
10
0
Classification
Subtest (A)
Non-Classification
Subtest (B)

FIGURE 1

Mean Percentage Scores Adjusted for Covariate Non-Classification Subtest (Subtest B)

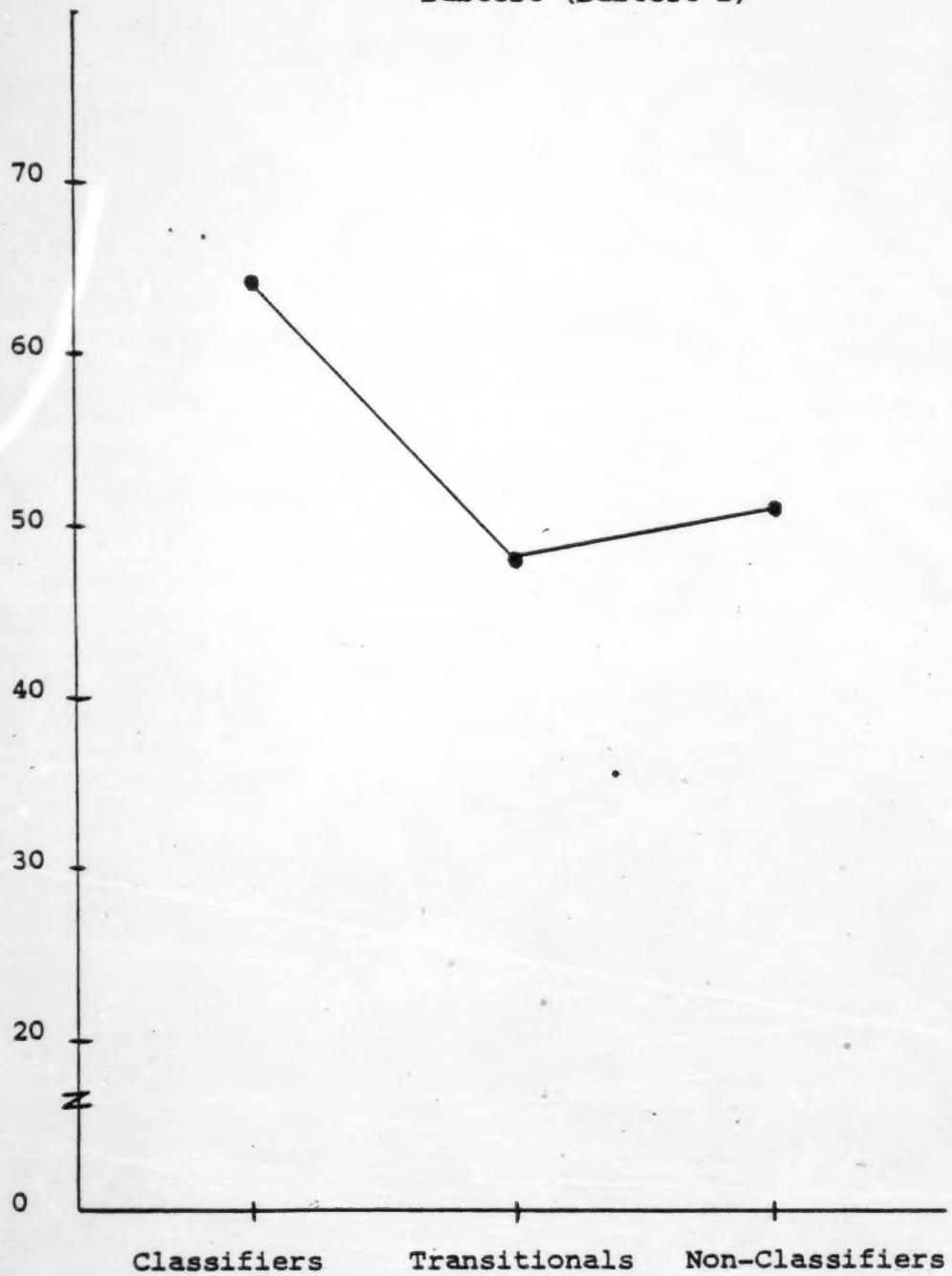

FIGURE 2